Mapping Viewsheds: time for another look

The Project:

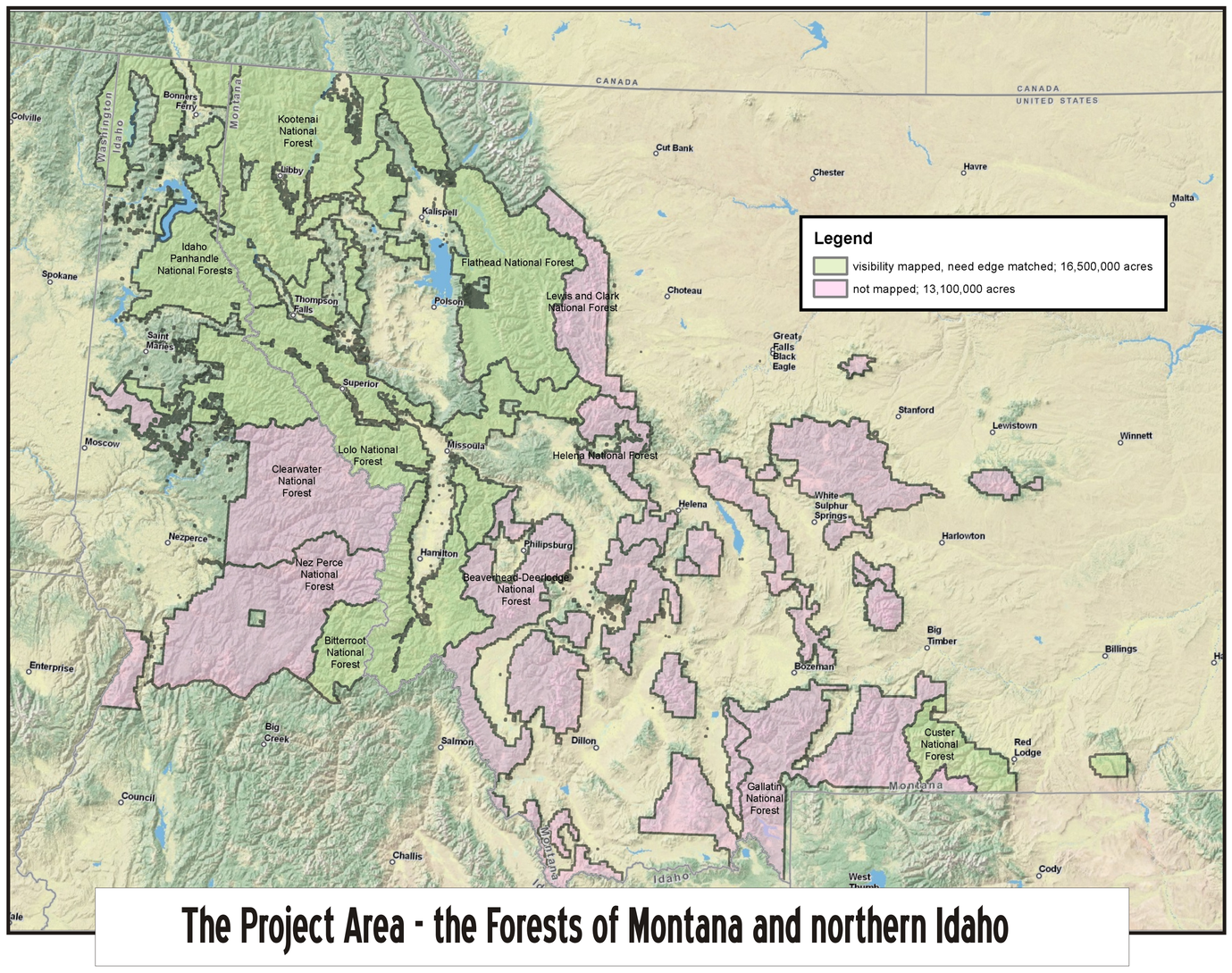
Complete visibility mapping for 30 million acres of adjacent National Forests in Montana and Idaho.

The Problem:

Testing of the Viewshed tool in Spatial Analyst determined that the time to complete the analysis is directly proportional to the number of viewpoints and the number of cells being mapped. With the given project, conventional analysis would take about 20,000 hours to compute (2 ½ years!). The project is only funded for about 50 days.

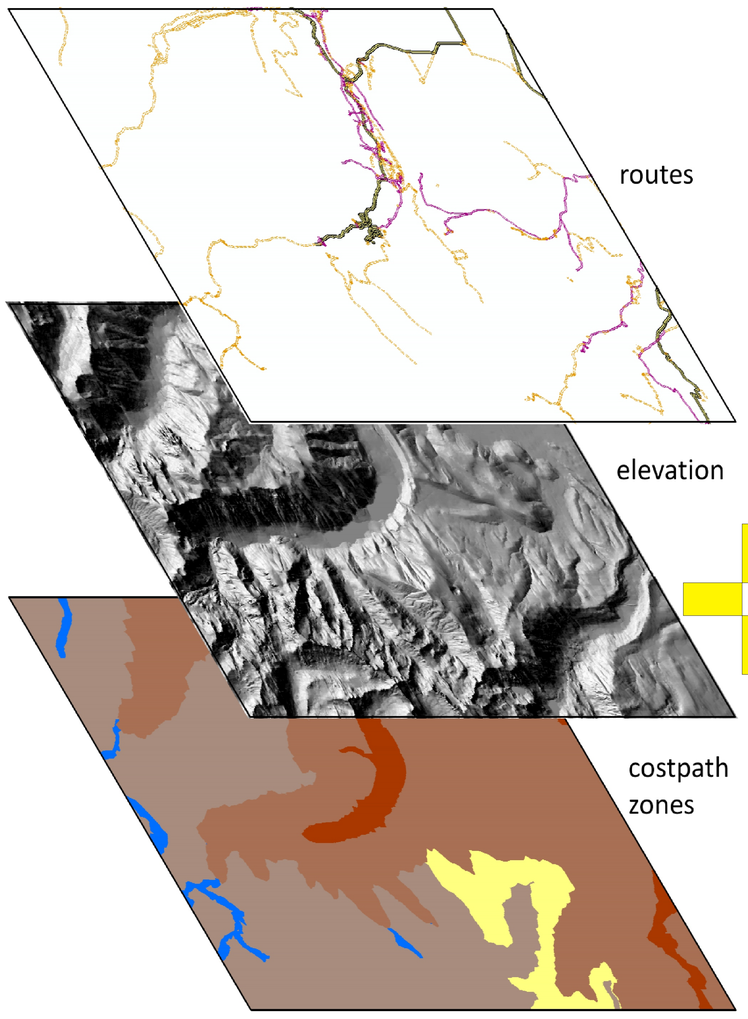
A Solution:

A solution was to use surface roughness to approximate viewed zones and then model viewed areas at a much coarser scale. The two models are then combined, using the coarse visibility to mask viewed zones at the middleground and background levels. Using this method is 20 times faster than the conventional viewshed computation.



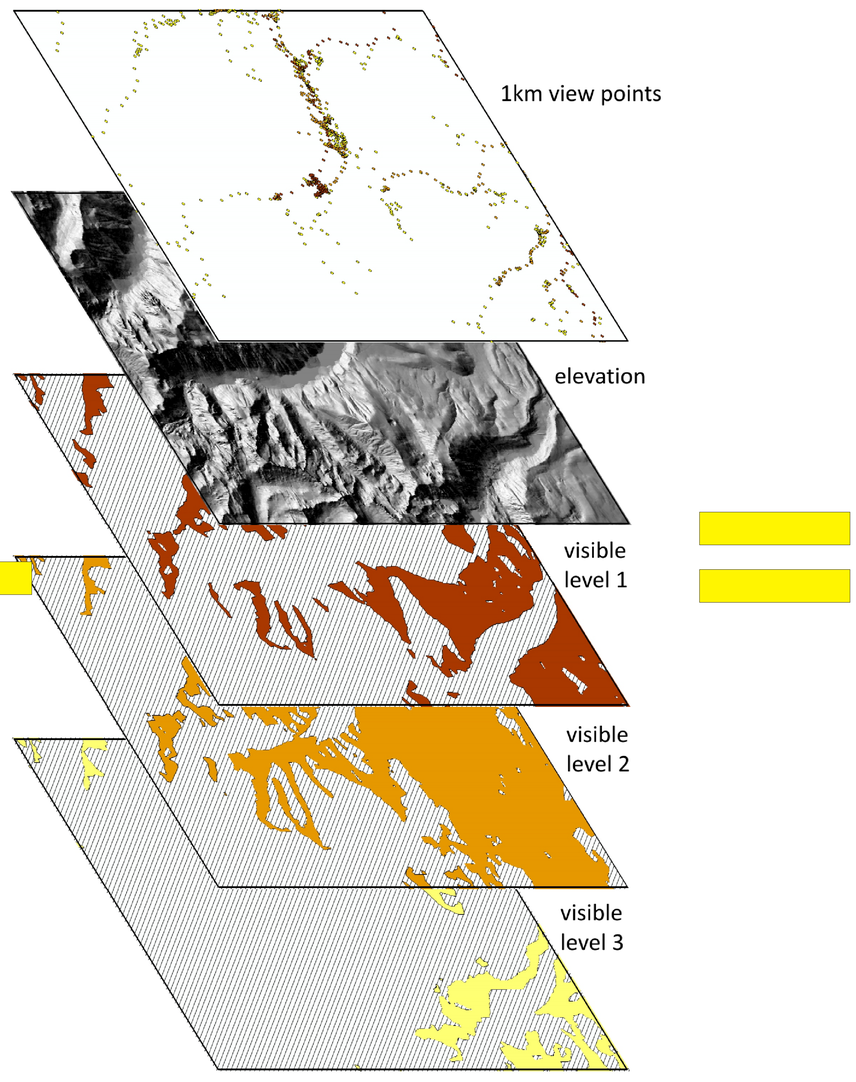
The Project Area - the Forests of Montana and northern Idaho

Viewshed Zones



The change in elevation between cells can provide an indication of how difficult it may be to see across the cell. Using this value as an indicator of impedence, costpaths can be mapped using the routes as a source. This analysis is relatively fast, and does a good job at representing visibility close to the vantage points. However, this method cannot determine when areas cannot be seen.

Coarse Visibility

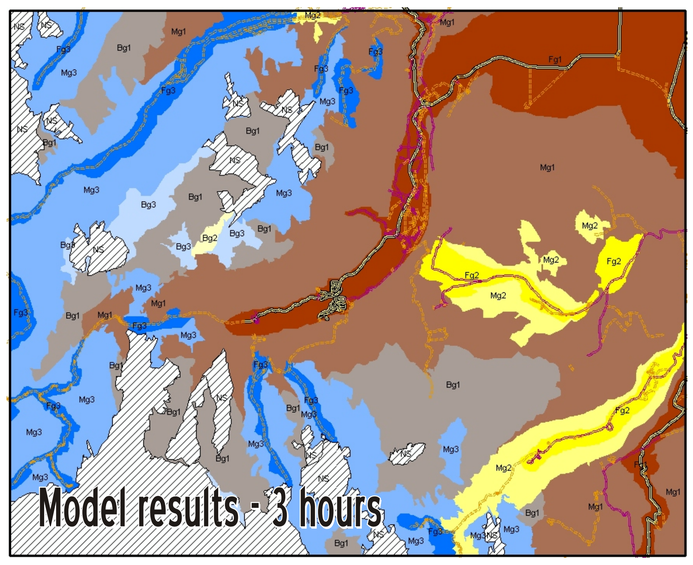


Visibility in the middleground and background areas can be determined by a coarse grid of points. This can be accomplished by combining the routes with a 1km fishnet using the feature-to-line tool, and then deleting the fishnet and converting the remaining segments to points. Limiting the elevation raster to a buffer around these points further reduces computational time.

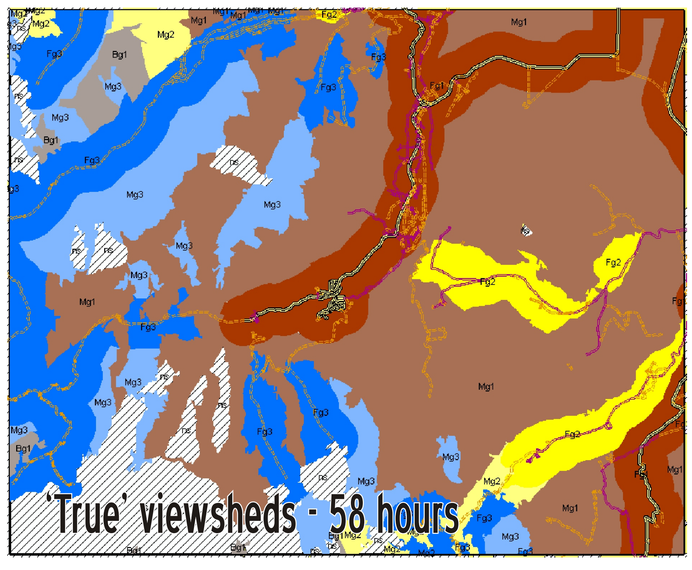
Modeled Visibility

The coarse visibility can be used as a mask of the middleground and background viewshed zones to create a viewshed map that is reasonably close to the actual viewshed. Computational time is 5 percent of what a full viewshed calculation would take, making mapping of large areas with complex observation sources possible.

The model creates variable boundaries between foreground, middleground and background which better represents the on-the-ground experience. It also maps more areas as seldom seen by dropping out areas that are only seen by a few, of the many viewpoints.



The map below shows the results of a complete viewshed mapping exercise, using each of the three levels of route concern. This map took 58 hours to compile and represents only a very small portion of the forest.



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United States Department of Agriculture